TECHNICAL FIELD

[Field of the Invention] This invention relates to the drive approach of an injection molding machine and equipment equipped with the both sides of an oil pressure mechanical component which have the electric mechanical component which has an electric actuator, and an actuator.

PRIOR ART

[Description of the Prior Art] Generally, the injection process (speed-control field) which carries out injection restoration of the resin in a heating cylinder at metal mold, and the dwelling process (pressure regulatory region) which pressurizes the resin with which the screw was filled up in metal mold exist in the forming cycle in an injection molding machine by carrying out advance migration of the screw. On the other hand, the electric drive method which carries out the advance drive of the screw with electric actuators, such as a servo motor, and the hydraulic-drive method which carries out the advance drive of the screw with actuators, such as an oil hydraulic cylinder, exist in the driving gear of an injection molding machine. In this case, although it is suitable for speed control at the time of carrying out advance migration of the screw in order that an electric drive method may change rotation driving force, such as a servo motor, in the rectilinear-propagation direction and may carry out the advance drive of the screw, a screw is hardly suitable for the pressure control used as a idle state. On the other hand, although the screw is suitable for the pressure control which will almost be in a idle state, a hydraulic-drive method is not suitable for speed control at the time of carrying out advance migration of the screw, in order to carry out the advance drive of the direct screw with welding pressure.

For this reason, while the combination of an electric servo motor and an oil pressure device constitutes the injection unit section and controlling an injection speed by the former with an electric servo motor, the injection molding machine which controlled the dwelling force by the oil pressure device is also known for JP,4-189525,A.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the conventional injection molding machine mentioned above had the following troubles.

In the first place, since quite big torque is needed, in order to secure the improvement in the speed in the acceleration section concerned, stability, responsibility, and repeatability, a fairly big servo motor is needed in the acceleration section started from the idle state in the speed-control field which carries out advance migration of the screw to a constant-speed condition. Therefore, while causing whole enlargement and a whole cost rise, a limitation is shown in attaining a raise in capacity and high-performance-izing of the injection molding machine using a servo motor.

[0006] In order to use [second] a servo motor and an oil pressure device alternatively, at the dwelling process which gives the dwelling force, a servo motor is not used only using an oil pressure device. Therefore, since it is necessary to have the capacity for the oil pressure device itself to give the maximum dwelling force while being unable to aim at a deployment of a functional part, enlargement and a cost rise of an oil pressure device are caused.

[0007] This invention realizes a miniaturization and low-cost-izing of an electric mechanical component and an oil pressure mechanical component to coincidence, in addition aims at high-performance-izing of an injection molding machine, the drive approach of the injection molding machine which can raise possibilities further, and offer of equipment while it solves the technical problem which exists in such a Prior art and raises the improvement in the speed at the time of electric actuator use, stability, responsibility, and repeatability by leaps and bounds.

[0008] [The means for solving a technical problem and the gestalt of operation] The electric mechanical component 2 to which the drive approach of the injection molding machine concerning this invention carries out the advance drive of the movable object (screw S) with an electric actuator, It faces driving an injection molding machine equipped with the oil pressure mechanical component 4 which carries out the advance drive of the movable object with an actuator. First, while computing the assist pressure force Pa of the predetermined ratio (assistant ratio) K over the load pressure Po concerned by carrying out the advance drive of the movable object by controlling the electric mechanical component 2, and detecting the load pressure Po at the time of the advance drive concerned It is characterized by pressurizing Screw S according to the assist pressure force Pa concerned by controlling the oil pressure mechanical component 4.

[0009] According to the gestalt of suitable operation, in this case, the assistant ratio K Can make it differ for every regulatory region, and especially the assistant ratio K of the acceleration section Z1 in a speed-control field, or the moderation section Z2 As for the assistant ratio K of 50-80 [%], and the pressure regulatory region Z4, it is [the assistant ratio K of the constant-speed section Z3 in 80-100 [%], and a speed-control field] desirable to set it as 60-70 [%], respectively.

[0010] On the other hand, the driving gear 1 of the injection molding machine concerning this invention The electric mechanical component 2 which carries out the advance drive of the movable object (screw S) with an electric actuator (servo motor 3), In a driving gear equipped with the oil pressure mechanical component 4 which carries out the advance drive of the movable object with an actuator (oil hydraulic cylinders 5, 5a, and 5b) When the advance drive of the movable object is carried out by controlling the electric mechanical component 2 especially, while computing the assist pressure force Pa of the predetermined ratio (assistant ratio) K over the load pressure Po concerned by detecting a load pressure Po It is characterized by forming the control function section 6 which pressurizes a movable object according to the

assist pressure force Pa concerned by controlling the oil pressure mechanical component 4.

[0011] If the electric mechanical component 2 is controlled and the advance drive of the movable object is carried out by this, in the control function section 6, the load pressure Po at the time of the advance drive concerned will be detected, and the assist pressure force Pa will be computed based on the assistant ratio K set up beforehand. And the oil pressure mechanical component 4 is controlled by the control function section 6, and a movable object is pressurized according to the assist pressure force Pa concerned. That is, it is pressurized by the assist pressure force Pa by the oil pressure mechanical component 4, and the pressure of the electric mechanical component 2 and the oil pressure mechanical component 4 is shared by the optimal assistant ratio K set up for every regulatory region in this case at the same time the advance drive of the movable object is carried out by the electric mechanical component 2.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001] [Field of the Invention] This invention relates to the drive approach of an injection molding machine and equipment equipped with the both sides of an oil pressure mechanical component which have the electric mechanical component which has an electric actuator, and an actuator.

[0002] [Description of the Prior Art] Generally, the injection process (speed-control field) which carries out injection restoration of the resin in a heating cylinder at metal mold, and the dwelling process (pressure regulatory region) which pressurizes the resin with which the screw was filled up in metal mold exist in the forming cycle in an injection molding machine by carrying out advance migration of the screw. On the other hand, the electric drive method which carries out the advance drive of the screw with electric actuators, such as a servo motor, and the hydraulic-drive method which carries out the advance drive of the screw with actuators, such as an oil hydraulic cylinder, exist in the driving gear of an injection molding machine. In this case, although it is suitable for speed control at the time of carrying out advance migration of the screw in order that an electric drive method may change rotation driving force, such as a servo motor, in the rectilinear-propagation direction and may carry out the advance drive of the screw, a screw is hardly suitable for the pressure control used as a idle state. On the other hand, although the screw is suitable for the pressure control which will almost be in a idle state, a hydraulic-drive method is not suitable for speed control at the time of carrying out advance migration of the screw, in order to carry out the advance drive of the direct screw with welding pressure.

[0003] For this reason, while the combination of an electric servo motor and an oil pressure device constitutes the injection unit section and controlling an injection

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[0004] [Problem(s) to be Solved by the Invention] However, the conventional injection molding machine mentioned above had the following troubles.

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[0007] This invention realizes a miniaturization and low-cost-izing of an electric mechanical component and an oil pressure mechanical component to coincidence, in addition aims at high-performance-izing of an injection molding machine, the drive approach of the injection molding machine which can raise possibilities further, and offer of equipment while it solves the technical problem which exists in such a Prior art and raises the improvement in the speed at the time of electric actuator use, stability, responsibility, and repeatability by leaps and bounds.

[0008] [The means for solving a technical problem and the gestalt of operation] The electric mechanical component 2 to which the drive approach of the injection molding machine concerning this invention carries out the advance drive of the movable object (screw S) with an electric actuator, It faces driving an injection molding machine equipped with the oil pressure mechanical component 4 which carries out the advance drive of the movable object with an actuator. First, while computing the assist pressure force Pa of the predetermined ratio (assistant ratio) K over the load pressure Po concerned by carrying out the advance drive of the movable object by controlling the electric mechanical component 2, and detecting the load pressure Po at the time of the advance drive concerned It is characterized by pressurizing Screw S according to the assist pressure force Pa concerned by controlling the oil pressure mechanical component 4.

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[0010] On the other hand, the driving gear 1 of the injection molding machine concerning this invention The electric mechanical component 2 which carries out the advance drive of the movable object (screw S) with an electric actuator (servo motor 3), In a driving gear equipped with the oil pressure mechanical component 4 which carries out the advance drive of the movable object with an actuator (oil hydraulic cylinders 5, 5a, and 5b) When the advance drive of the movable object is carried out by controlling the electric mechanical component 2 especially, while computing the assist pressure force Pa of the predetermined ratio (assistant ratio) K over the load pressure Po concerned by detecting a load pressure Po It is characterized by forming the control function section 6 which pressurizes a movable object according to the assist pressure force Pa concerned by controlling the oil pressure mechanical component 4.

[0011] If the electric mechanical component 2 is controlled and the advance drive of the movable object is carried out by this, in the control function section 6, the load pressure Po at the time of the advance drive concerned will be detected, and the assist pressure force Pa will be computed based on the assistant ratio K set up beforehand. And the oil pressure mechanical component 4 is controlled by the control function section 6, and a movable object is pressurized according to the assist pressure force Pa concerned. That is, it is pressurized by the assist pressure force Pa by the oil pressure mechanical component 4, and the pressure of the electric mechanical component 2 and the oil pressure mechanical component 4 is shared by the optimal assistant ratio K set up for every regulatory region in this case at the same time the advance drive of the movable object is carried out by the electric mechanical component 2.

[0012] [Example] Next, the suitable example concerning this invention is given and it explains to a detail based on a drawing.

[0013] First, the configuration of the injection molding machine containing the driving gear 1 concerning this example is explained with reference to drawing 1 - drawing 4 .

[0014] Drawing 4 shows injection equipment Mi and constitutes an injection molding machine with this injection equipment Mi and non-illustrated mold clamp equipment. As shown in drawing 3 , injection equipment Mi is equipped with a heating cylinder 11, and loads the interior of this heating cylinder 11 with Screw S. A heating cylinder 11 equips a posterior part with a non-illustrated hopper, and combines the back end of a heating cylinder 11 with the pre-block 12 while it has the injection nozzle which is

not illustrated to the front end. It has block 13, after estranging behind the pre-block 12, and between block 13 and the pre-block 12, two or more level guide shaft 14 -- is constructed after this.

[0015] Moreover, while loading guide shaft 14 -- with the movable block 15, enabling a free slide, on the core of this movable block 15, i.e., the same axis as Screw S, Rota 16 is supported through bearings 17 and 18, enabling free rotation, and the back end of Screw S is combined with the front end of this Rota 16. In this case, between the bearing 18 on the backside, and the movable block 15, the pressure sensor (load cell) 19 which detects the load pressure Po of Screw S is arranged. Furthermore, the servo motor 20 for screw rotation (for measuring) is attached in the movable block 15, and the rotation shaft of this servo motor 20 and Rota 16 are connected according to the rotation transfer device 21. The rotation transfer device 21 consists of an endless transfer belt 24 over which it built between the drive gear 22 attached in the rotation shaft of a servo motor 20, the passive-movement gear 23 attached in Rota 16, the drive gear 22, and the passive-movement gear 23. 25 is a position sensor which detects the location of the movable block 15, i.e., the location of Screw S.

[0016] On the other hand, an oil hydraulic cylinder (actuator) 5 is arranged on the same axis as the screw S in the post-block 13. An oil hydraulic cylinder 5 builds in both rods type piston 5p, and while projecting the front rod of this piston 5p from the front end of an oil hydraulic cylinder 5 to the front and combining with the back end of the movable block 15, the back rod of piston 5p projects from the back end of an oil hydraulic cylinder 5 to back. The order rod of both rods type piston 5p is a diameter of said.

EFFECT OF THE INVENTION

[Effect of the Invention] Thus, since the movable object was pressurized according to the assist pressure force concerned by controlling an oil pressure mechanical component while the drive approach (equipment) of the injection molding machine concerning this invention computed the assist pressure force of a predetermined ratio over the load pressure concerned by carrying out the advance drive of the movable object by controlling an electric mechanical component, and detecting the load pressure at the time of the advance drive concerned, it does the following remarkable effectiveness so since the pressure of an electric mechanical component and an oil pressure mechanical component is shared by the optimal assistant ratio set up for every regulatory region, while being able to raise the improvement in the speed at the time of electric actuator use, stability, responsibility, and repeatability by leaps and bounds -- high-performance-izing of an injection molding machine -- possibilities can be raised further.

Since an electric mechanical component and an oil pressure mechanical component are used for coincidence, they can attain a miniaturization and low-cost-izing of the

both sides of an electric mechanical component and an oil pressure mechanical component.

EXAMPLE

[Example] Next, the suitable example concerning this invention is given and it explains to a detail based on a drawing.

[0013] First, the configuration of the injection molding machine containing the driving gear 1 concerning this example is explained with reference to drawing 1 - drawing 4 .

[0014] Drawing 4 shows injection equipment Mi and constitutes an injection molding machine with this injection equipment Mi and non-illustrated mold clamp equipment. As shown in drawing 3 , injection equipment Mi is equipped with a heating cylinder 11, and loads the interior of this heating cylinder 11 with Screw S. A heating cylinder 11 equips a posterior part with a non-illustrated hopper, and combines the back end of a heating cylinder 11 with the pre-block 12 while it has the injection nozzle which is not illustrated to the front end. It has block 13, after estranging behind the pre-block 12, and between block 13 and the pre-block 12, two or more level guide shaft 14 -- is constructed after this.

[0015] Moreover, while loading guide shaft 14 -- with the movable block 15, enabling a free slide, on the core of this movable block 15, i.e., the same axis as Screw S, Rota 16 is supported through bearings 17 and 18, enabling free rotation, and the back end of Screw S is combined with the front end of this Rota 16. In this case, between the bearing 18 on the backside, and the movable block 15, the pressure sensor (load cell) 19 which detects the load pressure Po of Screw S is arranged. Furthermore, the servo motor 20 for screw rotation (for measuring) is attached in the movable block 15, and the rotation shaft of this servo motor 20 and Rota 16 are connected according to the rotation transfer device 21. The rotation transfer device 21 consists of an endless transfer belt 24 over which it built between the drive gear 22 attached in the rotation shaft of a servo motor 20, the passive-movement gear 23 attached in Rota 16, the drive gear 22, and the passive-movement gear 23. 25 is a position sensor which detects the location of the movable block 15, i.e., the location of Screw S.

[0016] On the other hand, an oil hydraulic cylinder (actuator) 5 is arranged on the same axis as the screw S in the post-block 13. An oil hydraulic cylinder 5 builds in both rods type piston 5p, and while projecting the front rod of this piston 5p from the front end of an oil hydraulic cylinder 5 to the front and combining with the back end of the movable block 15, the back rod of piston 5p projects from the back end of an oil hydraulic cylinder 5 to back. The order rod of both rods type piston 5p is a diameter of said. Since a closed circuit system can be constituted by using such both rods type, there is an advantage which can do the amount of hydraulic oil few. Moreover, the supporter 26 which extended back is formed in the back end of the post-block 13.

On the same axis as piston 5p in a supporter 26, a ball screw 27 is supported enabling free rotation, the before [this ball screw 27] side screw section is screwed in the ball nut 28 fixed to the back rod of piston 5p, and the ball screw device 29 is constituted. Furthermore, the servo motor 3 (electric actuator) for screw advance (for injection) is attached in a supporter 26, and the rotation shaft and ball screw 27 of this servo motor 3 are connected according to the rotation transfer device 30. The rotation transfer device 30 consists of an endless transfer belt 33 over which it built between the drive gear 31 attached in the rotation shaft of a servo motor 3, the passive-movement gear 32 attached in the back end of a ball screw 27, the drive gear 31, and the passive-movement gear 32.

[0017] On the other hand, the oil pressure control circuit 40 shown in drawing 4 is connected to an oil hydraulic cylinder 5. This oil pressure control circuit 40 and oil hydraulic cylinder 5 constitute the oil pressure mechanical component 4. In this oil pressure control circuit 40, the relief valve 45 which connected between the variable-capacity mold hydraulic pump 44 connected with the 4 port change-over valve 41 linked to an oil hydraulic cylinder 5 and this 4 port change-over valve 41 through the check valve 43 between oil tanks 42, and the delivery of this hydraulic pump 44 and an oil tank 42, and the pressure control valve 46 which connected between the deliveries of cam-plate angle control cylinder 44s of a hydraulic pump 44 and the hydraulic pump 44 concerned are included. Moreover, the oil pressure control circuit 40 is equipped with the pump-control section 47, and while the detection result of the discharge pressure of the hydraulic pump 44 detected by the pressure sensor 48 is given to this pump-control section 47, the pump-control section 47 gives the pressure control signal Ps to a pressure control valve 46 through amplifier 49. In addition, in the pump-control section 47, as shown in drawing 1 The pressure command value Pa The deflection of the transducer 51 changed into the amount of pressure operated, the deflection operation part 52 which obtains the deflection of the control input obtained from this transducer 51, and the amount of pressure detection obtained from a pressure sensor 48, the compensation section 53 which compensates the output of this deflection operation part 52, and the output of this compensation section 53 and the output (pressure) given from a hydraulic-circuit 54 side While the deflection operation part 55 to obtain is included, the pressure control valve 46 and hydraulic pump 44 which were mentioned above are included in a hydraulic circuit 54. And the output of the deflection operation part 55 serves as said pressure control signal Ps by being amplified with amplifier 49, and this pressure control signal Ps is given to a pressure control valve 46.

[0018] Moreover, in drawing 4 , 61 is the motor control section by the side of screw rotation, and the output side of this motor control section 61 connects to the input side of the motor control section 61 the rotary encoder 63 which detects the rotational frequency of a servo motor 20 while connecting with a servo motor 20 through amplifier 62.

[0019] Furthermore, 65 is the motor control section by the side of screw advance, and the output side of this motor control section 65 connects to the input side of the motor control section 65 the rotary encoder 67 which detects the rotational frequency of a servo motor 3 while connecting with a servo motor 3 through amplifier 66. This servo motor 3, the motor control section 65, amplifier 66, and a rotary encoder 67 constitute the electric mechanical component 2. In addition, as shown in drawing 1 , the transducer 72 which changes the command value Dc into a control input, the deflection operation part 73 which obtains the deflection of the control input which obtains from this transducer 72, and the amount of detection, the compensation section 74 which compensates the output of this deflection operation part 73, and the deflection operation part 75 which obtains the deflection of the output of this compensation section 74 and the output of a servo motor 3 are included in the motor control section 65. And the output of the deflection operation part 75 serves as a control signal Ds by being amplified with amplifier 66, and this control signal Ds is given to a servo motor 3.

[0020] On the other hand, 70 is the Maine controller, and it connects the I/O section 71 containing a setter and a drop while it connects the pump-control section 47 and the motor control sections 61 and 65 which were mentioned above. The location property operation part 81 shown in drawing 1 , the rate property operation part 82, the pressure-characteristics operation part 83, the deflection operation part 84 and 85, and the change-over section 86 are included in this Maine controller 70. Moreover, the rate setting section 91 shown in drawing 1 , the location section 92, and the setting pressure section 93 are included in the I/O section 71. And the pressure sensor 19 mentioned above connects a position sensor 25 to the location property operation part 81, the change-over section 86, and a speed detector 87, respectively while connecting with the pressure-characteristics operation part 83 and the rate property operation part 82, respectively. In this case, a speed detector 87 is changed into a rate by differentiating the detection result of a position sensor 25 by time amount, and this conversion result is given to the rate property operation part 82. In addition, a control input is given to the location property operation part 81, the rate property operation part 82, and the pressure-characteristics operation part 83 from a transducer 72, respectively. Moreover, while the output of the pressure-characteristics operation part 83 and the output of the rate property operation part 82 are given to the input side of the deflection operation part 84, the output of the deflection operation part 84 and the output of the location property operation part 81 are given to the input side of the deflection operation part 85, and the output of the deflection operation part 85 is further given to the input side of the deflection operation part 73 with the output (control input) of a transducer 72.

[0021] Moreover, the Maine controller 70 is equipped with the assist pressure force operation part 100 according to this invention. While the change-over signal (condition signal) Sc is given to this assist pressure force operation part 100 from the change-over section 86, the load pressure Po detected by the pressure sensor 19 is

given. The assist pressure force operation part 100 and a pressure sensor 19 constitute the control function section 6, and they have the function which pressurizes Screw S according to the assist pressure force Pa concerned by controlling the oil pressure mechanical component 4 while they compute the assist pressure force Pa based on the predetermined ratio K to the load pressure Po detected by the pressure sensor 19, i.e., an assistant ratio.

[0022] The assistant ratio K is beforehand set as the assist pressure force operation part 100, and is changed for every regulatory region. In addition, the assistant ratio K uses the setter in the I/O section 71, and can set up and change it into arbitration. As magnitude of the assistant ratio K, as shown in drawing 2 , it is set as 80-100 [%] in the acceleration section Z1 or the moderation section Z2 in a speed-control field (dynamic area). In this case, any sections Z1 and Z2 are transients, and in order that loads may increase or decrease in number rapidly, as for the assistant ratio K, a comparatively big value is set up. In addition, in the moderation section Z2, actuation of a servo motor 3 is suspended, the mode braked by the oil hydraulic cylinder 5 is also contained, and the assistant ratio K at this time becomes 100%. Moreover, the assistant ratio K of the constant-speed section Z3 in a speed-control field sets the assistant ratio K of the pressure regulatory region (static area) Z4 as 60-70 [%] while setting it as 50-80 [%]. The field which can set such an assistant ratio K as arbitration according to loaded condition etc., for example, Screw S moves to a high speed can set up the assistant ratio K greatly.

[0023] Next, actuation of an injection molding machine including the drive approach concerning this example is explained with reference to each drawing.

[0024] First, at a measuring process, by carrying out drive control of the servo motor 20, Screw S rotates and measuring are recording of the melting resin in a heating cylinder 11 is carried out ahead [of Screw S]. And it shifts to a injection process by termination of a measuring process, and when Screw S moves forward, injection restoration of the melting resin measured in the heating cylinder 11 is carried out at metal mold.

[0025] At a injection process, the rate command value (Dc) set up by the rate setting section 91 is first given to a transducer 72 through the change-over section 86. By it, a rate command value serves as the amount of speed control (Ds) through the deflection operation part 73, the compensation section 74, the deflection operation part 75, and amplifier 66, after being changed into a control input by the transducer 72, and this amount of speed control is given to a servo motor 3. Thereby, a servo motor 3 rotates and Screw S carries out advance migration according to the ball screw device 29. Under the present circumstances, the speed detection value of the screw S obtained from a speed detector 87 is given to the deflection operation part 75 through the rate property operation part 82 and the deflection operation part 84 and 85, and while feedback control is carried out so that a speed detection value may be in agreement with a rate command value, feedback control of a minor loop is

performed by giving the rotation output of a servo motor 3 to the deflection operation part 75.

[0026] Moreover, at the time of the start of a injection process, since a servo motor 3 rotates from a idle state, it serves as the acceleration section Z1. The information showing this acceleration section Z1 is given to the assist pressure force operation part 100 as a change-over signal (condition signal) Sc from the change-over section 86, and the assistant ratio K corresponding to the acceleration section Z1 set up beforehand is chosen in the assist pressure force operation part 100.

[0027] On the other hand, a pressure sensor 19 detects the load pressure Po accompanying advance migration of Screw S, and the detected load pressure Po is given to the assist pressure force operation part 100. And in the assist pressure force operation part 100, the assist pressure force Pa is computed by Pa=PoxK, and the pressure command value Pc corresponding to the computed assist pressure force Pa is given to a transducer 51. The pressure command value Pc is changed into the amount of pressure operated by the transducer 51, and an oil hydraulic cylinder 5 is pressurized by giving this amount of pressure operated to a pressure control valve 46 through the deflection operation part 52, the compensation section 53, the deflection operation part 55, and amplifier 49. That is, Screw S is pressurized by the assist pressure force Pa concerned by controlling the oil pressure mechanical component 4. Under the present circumstances, the pressure detection value acquired from a pressure sensor 48 is given to the deflection operation part 52, and while feedback control is carried out so that a pressure detection value may be in agreement with a pressure command value, feedback control of a minor loop is performed by giving the condition pressure of a hydraulic circuit 54 to the deflection operation part 55.

[0028] Thus, Screw S is pressurized by the assist pressure force Pa by the oil pressure mechanical component 4 at the same time an advance drive is carried out by the electric mechanical component 2. Under the present circumstances, since the assist pressure force Pa is added from an oil hydraulic cylinder 5 even if it is the section which needs large torque like the acceleration section Z1 which starts Screw S from a idle state to a constant-speed condition, since the pressure of the electric mechanical component 2 and the oil pressure mechanical component 4 is shared by the optimal assistant ratio K set up for every regulatory region, the improvement in the speed in this section, stability, responsibility, and repeatability are raised by leaps and bounds.

[0029] On the other hand, the constant-speed section Z3 (injection process) performed continuously, the moderation section Z2 (injection process), and control with the same still more nearly said of the pressure regulatory region Z4 (dwelling process) are performed. In each regulatory region (section), the assistant ratio K in the assist pressure force operation part 100 is chosen by the change-over signal Sc given from the change-over section 86, and the assist pressure force Pa of corresponding is computed. Thus, also in which regulatory region (section) in a

injection process and a dwelling process, they can realize a miniaturization and low-cost-izing of the both sides of the electric mechanical component 2 and the oil pressure mechanical component 4 while they can perform exact control, since the electric mechanical component 2 and the oil pressure mechanical component 4 operate based on the assignment pressure by the optimal assistant ratio K which operated to coincidence and was set up for every regulatory region.

[0030] Next, the example of modification of each part in the above-mentioned example is explained with reference to drawing 5 and drawing 6 .

[0031] Drawing 5 shows the example of modification of an oil hydraulic cylinder 5. The example of modification used guide shaft 14 -- as a piston rod, and attached direct piston 5ap and 5bp to this guide shaft 14 -- while it used the oil hydraulic cylinders 5a and 5b of a Uichi Hidari pair. By such configuration, there is an advantage which can shorten the overall length of an injection molding machine. In addition, about other configurations, although it has some difference into details, it is the same as the example fundamentally shown in drawing 3 . Therefore, in drawing 5 , while giving the same sign to the same part as drawing 3 and clarifying the configuration, the detailed explanation was omitted.

[0032] Moreover, drawing 6 shows the example of modification of a hydraulic pump. The example of drawing 3 illustrated the variable-capacity mold hydraulic pump 44. While this variable-capacity mold hydraulic pump 44 drives an oil pressure pump body with the pump motor which carries out constant-speed rotation, the discharge quantity of a hydraulic pump 44 is controlled by cam-plate angle control cylinder 44s by the control valve 46. On the other hand, the fixed regurgitation mold hydraulic pump 110 is used for the example of modification shown in drawing 6 , it drives the hydraulic pump 110 concerned with the servo motor 112 by which an engine speed is controlled by the controller 111, and, thereby, has the advantage which can make capacity of a hydraulic pump 110 small.

[0033] As mentioned above, although the example was explained to the detail, this invention is not limited to such an example, and can be changed, added and deleted to arbitration in the configuration of details, a configuration, quantity, a value, etc. in the range which does not deviate from the summary of this invention.
[0034] For example, although Screw S was illustrated as a movable object, this invention can be applied also like mold clamp equipment, and the movable object in this case serves as a movable head. Moreover, although the servo motor and the oil hydraulic cylinder were illustrated as an electric actuator and an actuator, other actuators which are not necessarily limited to these and have the same function can permute.